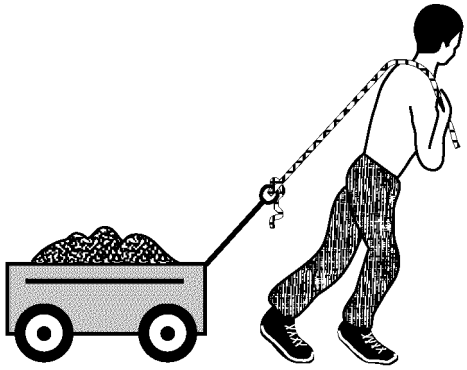
Practice Final C

1. The diagram below shows a worker using a rope to pull a cart.



The worker's pull on the handle of the cart can best be described as a force having

1) magnitude, only
2) direction, only
3) both magnitude and direction
4) neither magnitude nor direction

2. A car travels 90. meters due north in 15 seconds. Then the car turns around and travels 40. meters due south in 5.0 seconds. What is the magnitude of the average velocity of the car during this 20.-second interval?

1) 2.5 m/s
2) 5.0 m/s
3) 6.5 m/s
4) 7.0 m/s

3. How far will a brick starting from rest fall freely in 3.0 seconds?

1) 15 m
2) 29 m
3) 44 m
4) 88 m

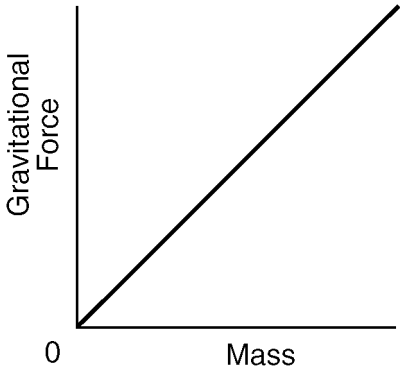
4. If the sum of all the forces acting on a moving object is zero, the object will

1) slow down and stop
2) change the direction of its motion
3) accelerate uniformly
4) continue moving with constant velocity

5. A net force of 10. Newtons accelerates an object at 5.0 meters per second^2. What net force would be required to accelerate the same object at 1.0 meter per second^2?

1) 1.0 N
2) 2.0 N
3) 5.0 N
4) 50. N

6. The graph below represents the relationship between gravitational force and mass for objects near the surface of Earth.



The slope of the graph represents the

1) acceleration due to gravity
2) universal gravitational constant
3) momentum of objects
4) weight of objects

7. A 1,200-kilogram car traveling at 10. meters per second hits a tree and is brought to rest in 0.10 second. What is the magnitude of the average force acting on the car to bring it to rest?

1) 1.2×10^2 N
2) 1.2×10^3 N
3) 1.2×10^4 N
4) 1.2×10^5 N

8. A spring scale reads 20. Newtons as it pulls a 5.0-kilogram mass across a table. What is the magnitude of the force exerted by the mass on the spring scale?

1) 49 N
2) 20. N
3) 5.0 N
4) 4.0 N

Base your answers to questions **9** and **10** on the information below.

A 2.0×10^3-kilogram car travels at a constant speed of 12 meters per second around a circular curve of radius 30. meters.

9. What is the magnitude of the centripetal acceleration of the car as it goes around the curve?

1) 0.40 m/s^2
2) 4.8 m/s^2
3) 800 m/s^2
4) 9,600 m/s^2

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10. As the car goes around the curve, the centripetal force is directed
    1) toward the center of the circular curve
    2) away from the center of the circular curve
    3) tangent to the curve in the direction of motion
    4) tangent to the curve opposite the direction of motion

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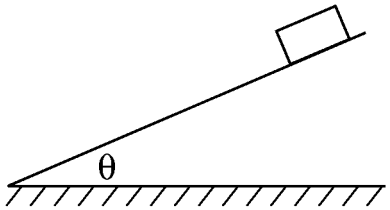
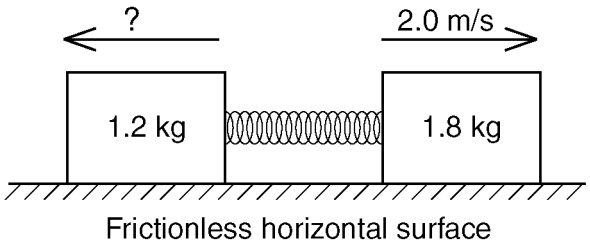
11. The diagram below shows a block sliding down a plane inclined at angle θ with the horizontal.



As angle θ is increased, the coefficient of kinetic friction between the bottom surface of the block and the surface of the incline will
    1) decrease
    2) increase
    3) remain the same

12. The amount of work done against friction to slide a box in a straight line across a uniform, horizontal floor depends most on the
    1) time taken to move the box
    2) distance the box is moved
    3) speed of the box
    4) direction of the box's motion

13. A 1.2-kilogram block and a 1.8-kilogram block are initially at rest on a frictionless, horizontal surface. When a compressed spring between the blocks is released, the 1.8-kilogram block moves to the right at 2.0 meters per second, as shown.



What is the speed of the 1.2-kilogram block after the spring is released?
    1) 1.4 m/s
    2) 2.0 m/s
    3) 3.0 m/s
    4) 3.6 m/s

14. An object weighs 100. Newtons on Earth's surface. When it is moved to a point one Earth radius above Earth's surface, it will weigh
    1) 25.0 N
    2) 50.0 N
    3) 100. N
    4) 400. N

15. An object weighing 15 Newtons is lifted from the ground to a height of 0.22 meter. The increase in the object's gravitational potential energy is approximately
    1) 310 J
    2) 32 J
    3) 3.3 J
    4) 0.34 J

16. As an object falls freely, the kinetic energy of the object
    1) decreases
    2) increases
    3) remains the same

17. Moving 2.5×10^{-6} coulombs of charge from point *A* to point *B* in an electric field requires 6.3×10^{-4} joules of work. The potential difference between points *A* and *B* is approximately
    1) 1.6×10^{-9} V
    2) 4.0×10^{-3} V
    3) 2.5×10^{2} V
    4) 1.0×10^{14} V

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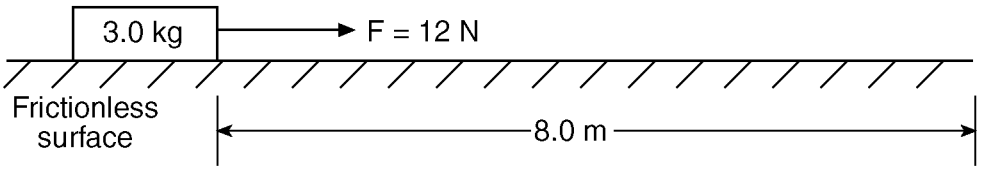
18. A 3.0-kilogram block is initially at rest on a frictionless, horizontal surface. The block is moved 8.0 meters in 2.0 seconds by the application of a 12-newton horizontal force, as shown in the diagram below.



What is the average power developed while moving the block?

1) 24 W
2) 32 W
3) 48 W
4) 96 W

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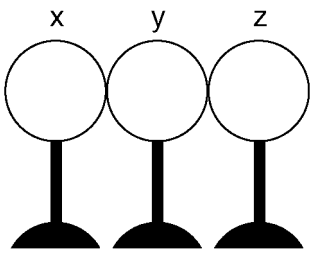
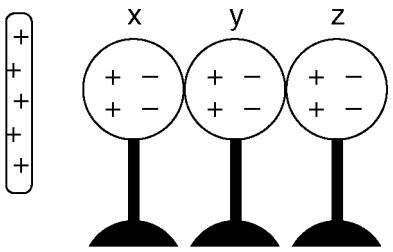
19. The diagram below shows three neutral metal spheres, *x, y,* and *z,* in contact and on insulating stands.

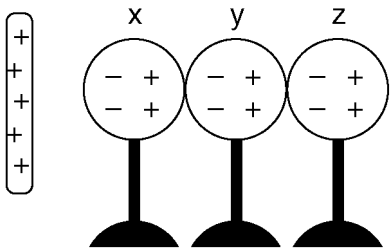


Which diagram best represents the charge distribution on the spheres when a positively charged rod is brought near sphere *x,* but does not touch it?

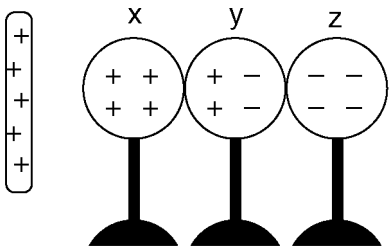
1)



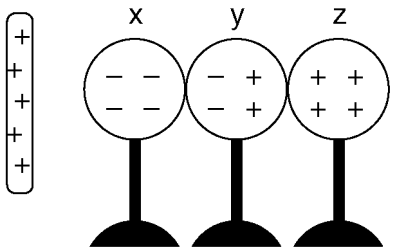
2)



3)



4)



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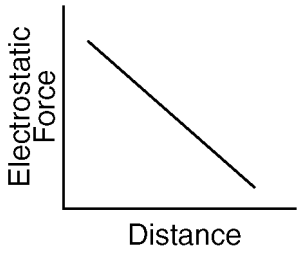
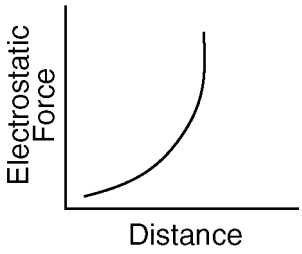
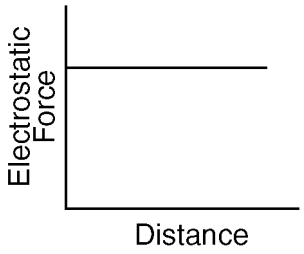
20. Which graph best represents the electrostatic force between an alpha particle with a charge of +2 elementary charges and a positively charged nucleus as a function of their distance of separation?

1) 

2) 

3) 

4) 

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21. When a neutral metal sphere is charged by contact with a positively charged glass rod, the sphere
    1) loses electrons
    2) gains electrons
    3) loses protons
    4) gains protons

22. If 10. coulombs of charge are transferred through an electric circuit in 5.0 seconds, then the current in the circuit is
    1) 0.50 A
    2) 2.0 A
    3) 15 A
    4) 50. A

23. The diagram below represents a source of potential difference connected to two large, parallel metal plates separated by a distance of 4.0×10^{-3} meter.

Which statement best describes the electric field strength between the plates?
    1) It is zero at point *B*.
    2) It is a maximum at point *B*.
    3) It is a maximum at point *C*.
    4) It is the same at points *A, B,* and *C*.

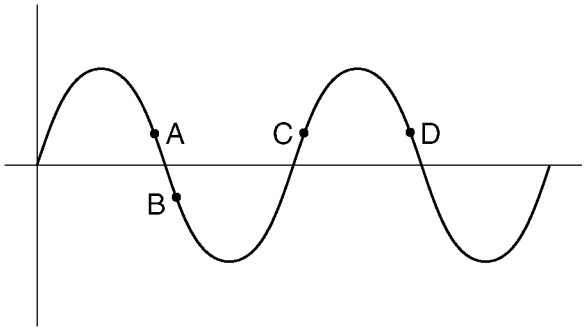
24. A periodic wave transfers
    1) energy, only
    2) mass, only
    3) both energy and mass
    4) neither energy nor mass

25. As the potential difference across a given resistor is increased, the power expended in moving charge through the resistor
    1) decreases
    2) increases
    3) remains the same

26. An electric iron operating at 120 volts draws 10. amperes of current. How much heat energy is delivered by the iron in 30. seconds?
    1) 3.0×10^2J
    2) 1.2×10^3J
    3) 3.6×10^3 J
    4) 3.6×10^4 J

27. A motor is used to produce 4.0 waves each second in a string. What is the frequency of the waves?
    1) 0.25 Hz
    2) 15 Hz
    3) 25 Hz
    4) 4.0 Hz

28. The diagram below shows a periodic wave.



Which points are in phase with each other?
    1) *A* and *C*
    2) *A* and *D*
    3) *B* and *C*
    4) *C* and *D*

29. A surfacing whale in an aquarium produces water wave crests having an amplitude of 1.2 meters every 0.40 second. If the water wave travels at 4.5 meters per second, the wavelength of the wave is
    1) 1.8 m
    2) 2.4 m
    3) 3.0 m
    4) 11 m

30. In a certain material, a beam of monochromatic light ($f = 5.09 \times 10^{14}$ hertz) has a speed of 2.25×10^8 meters per second. The material could be
    1) crown glass
    2) flint glass
    3) glycerol
    4) water

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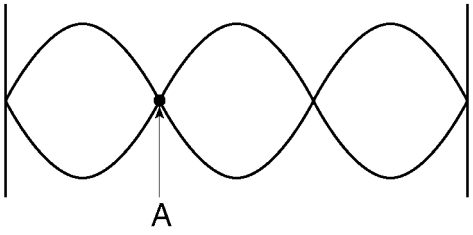
31. Orange light has a frequency of 5.0×10^{14} hertz in a vacuum. What is the wavelength of this light?
    1) 1.5×10^{23}m
    2) 1.7×10^{6}m
    3) 6.0×10^{-7} m
    4) 2.0×10^{-15} m

32. A radar gun can determine the speed of a moving automobile by measuring the difference in frequency between emitted and reflected radar waves. This process illustrates
    1) resonance
    2) the Doppler effect
    3) diffraction
    4) refraction

33. The diagram below shows a standing wave.

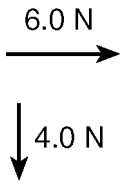


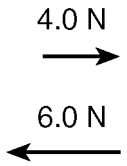
    Point *A* on the standing wave is
    1) a node resulting from constructive interference
    2) a node resulting from destructive interference
    3) an antinode resulting from constructive interference
    4) an antinode resulting from destructive interference

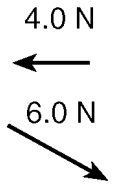
34. An object possessing an excess of 6.0×10^{6} electrons has a net charge of magnitude
    1) 2.7×10^{-26} C
    2) 5.5×10^{-24} C
    3) 3.8×10^{-13} C
    4) 9.6×10^{-13} C

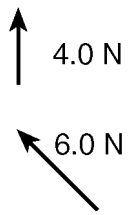
35. One watt is equivalent to one
    1) N•m
    2) N/m
    3) J•s
    4) J/s

36. Which pair of forces acting concurrently on an object will produce the resultant of greatest magnitude?

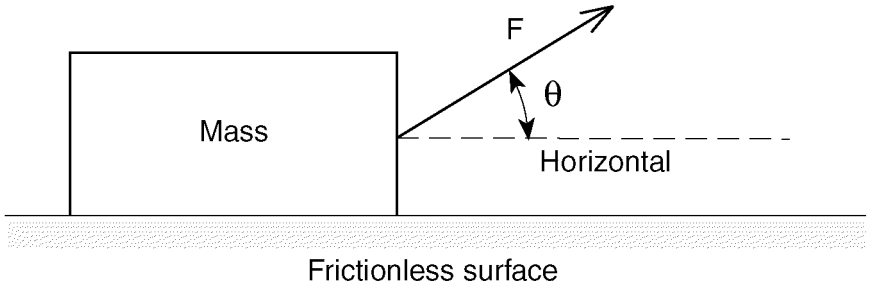
    1)


    2)


    3)


    4)


37. The diagram below shows a force of magnitude *F* applied to a mass at angle θ relative to a horizontal frictionless surface.



As angle θ is increased, the horizontal acceleration of the mass
1) decreases 2) increases 3) remains the same

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38. The mass of a high school football player is approximately
1) 10^0 kg
2) 10^1 kg
3) 10^2 kg
4) 10^3 kg

39. A constant force is used to keep a block sliding at constant velocity along a rough horizontal track. As the block slides, there could be an increase in its
1) gravitational potential energy, only
2) internal energy, only
3) gravitational potential energy and kinetic energy
4) internal energy and kinetic energy

40. A photon of which electromagnetic radiation has the most energy?
1) ultraviolet 3) infrared
2) x-ray 4) microwave

41. The spring of a toy car is wound by pushing the car backward with an average force of 15 Newtons through a distance of 0.50 meter. How much elastic potential energy is stored in the car's spring during this process?
1) 1.9 J 3) 30. J
2) 7.5 J 4) 56 J

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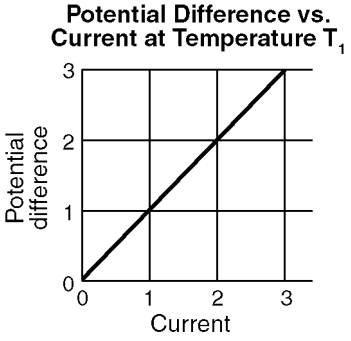
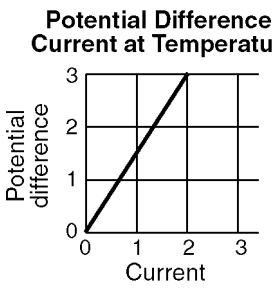
42. The graph below shows the relationship between the potential difference across a metallic conductor and the electric current through the conductor at constant temperature T_1.

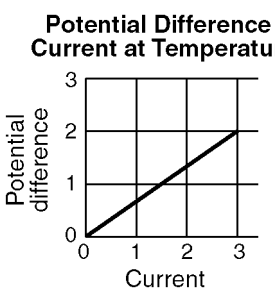


Which graph best represents the relationship between potential difference and current for the same conductor maintained at a higher constant temperature, T_2?

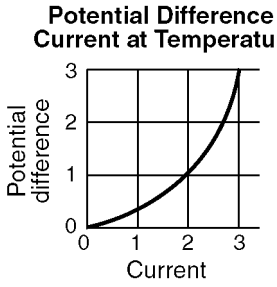
1)



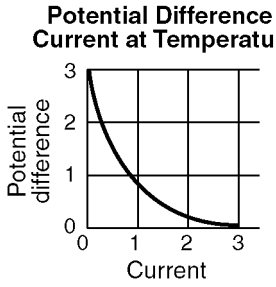
2)



3)



4)



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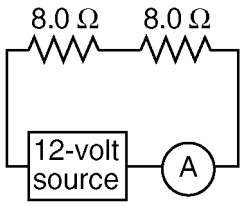
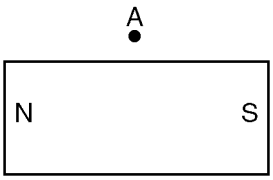
43. The diagram below shows a circuit with two resistors.



What is the reading on ammeter A?

1) 1.3 A
2) 1.5 A
3) 3.0 A
4) 0.75 A

44. The diagram below shows a bar magnet.



Which arrow best represents the direction of the needle of a compass placed at point A?

1) ↑
2) ↓
3) →
4) ←

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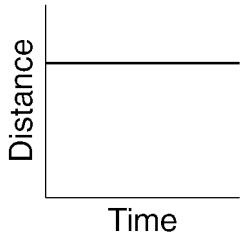
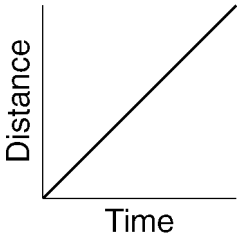
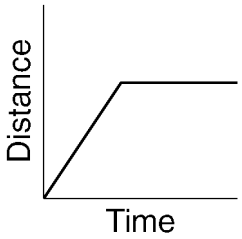
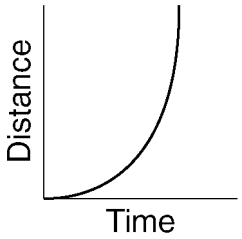
45. Which graph best represents the motion of a block accelerating uniformly down an inclined plane?

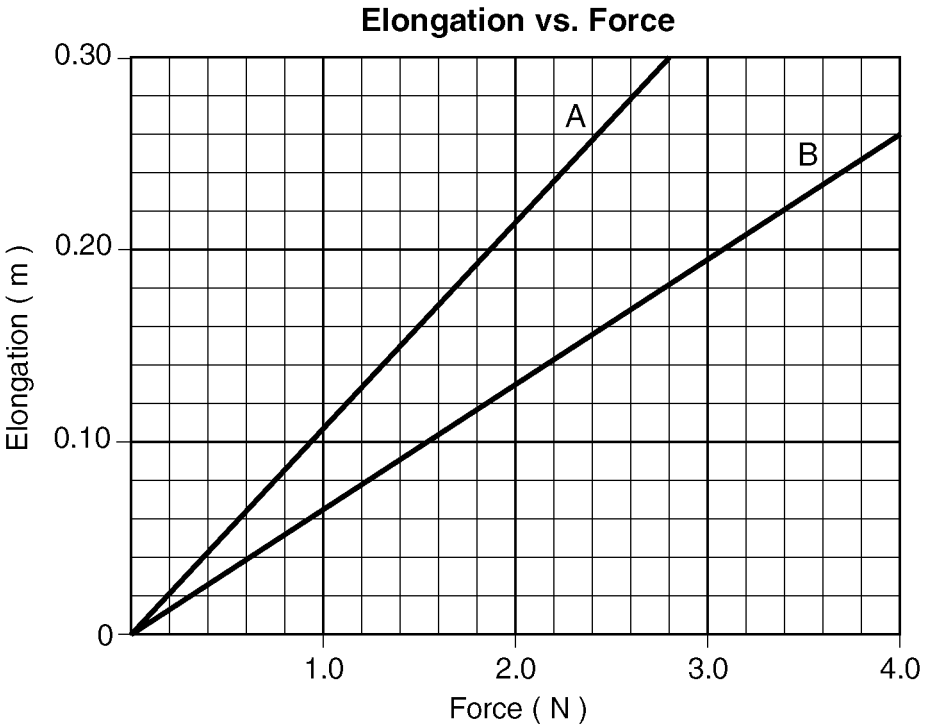
1) 

2) 

3) 

4) 

46. The graph below shows elongation as a function of the applied force for two springs, *A* and *B*.



Compared to the spring constant for spring *A*, the spring constant for spring *B* is
1) smaller 2) larger 3) the same

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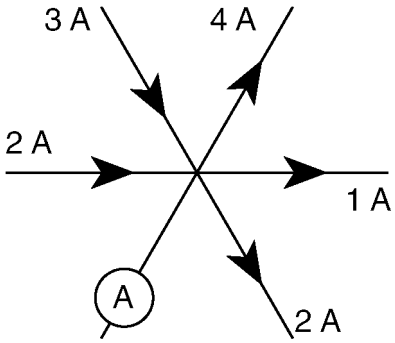
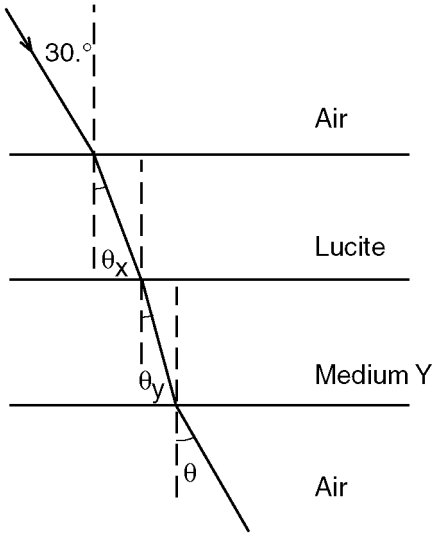
47. The diagram below represents currents in a segment of an electric circuit.



What is the reading of ammeter *A*?
1) 1 A 3) 3 A
2) 2 A 4) 4 A

Base your answers to questions **48** and **49** on the diagram below, which represents a light ray traveling from air to Lucite to medium *Y* and back into air.



48. The sine of angle θ_x is
1) 0.333 3) 0.707
2) 0.500 4) 0.886

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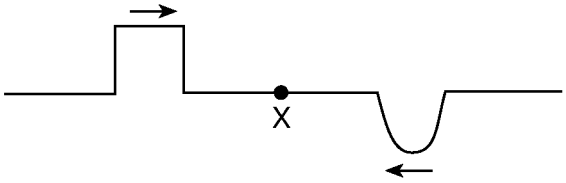
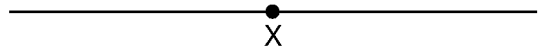
49. Light travels *slowest* in
    1) air, only
    2) Lucite, only
    3) medium *Y*, only
    4) air, Lucite, and medium *Y*

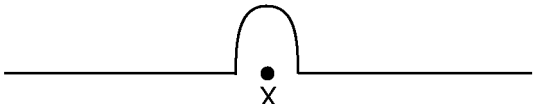
50. The diagram below shows two pulses traveling toward each other in a uniform medium.

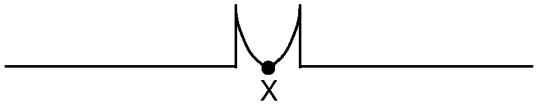


Which diagram best represents the medium when the pulses meet at point *X*?

1)


2)


3)


4)


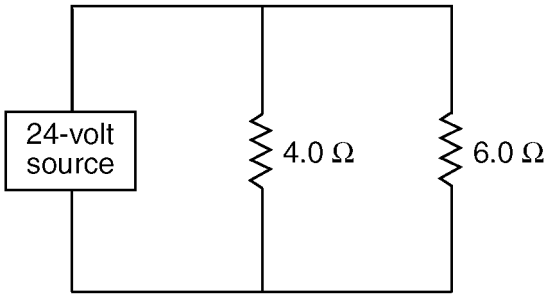
Base your answers to questions **51** and **52** on the information below.

An outfielder throws a baseball to the first baseman at a speed of 19.6 meters per second and an angle of 30.° above the horizontal.

51. Which pair represents the initial horizontal velocity (*vx*) and initial vertical velocity (*vy*) of the baseball?
    1) $v_x = 17.0$ m/s, $v_y = 9.80$ m/s
    2) $v_x = 9.80$ m/s, $v_y = 17.0$ m/s
    3) $v_x = 19.4$ m/s, $v_y = 5.90$ m/s
    4) $v_x = 19.6$ m/s, $v_y = 19.6$ m/s

52. If the ball is caught at the same height from which it was thrown, calculate the amount of time the ball was in the air.

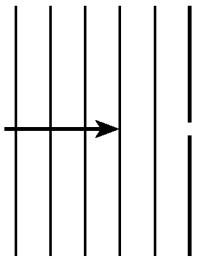
Base your answers to questions **53** and **54** on the circuit diagram below, which shows two resistors connected to a 24-volt source of potential difference.



53. On the diagram above, use the appropriate circuit symbol to indicate a correct placement of a voltmeter to determine the potential difference across the circuit.

54. What is the total resistance of the circuit?
    1) 0.42
    2) 2.4
    3) 5.0
    4) 10

55. The diagram below shows a plane wave passing through a small opening in a barrier.



On the diagram above, sketch four wave fronts after they have passed through the barrier.

56. What prevents the nucleus of a helium atom from flying apart?

Base your answers to questions **57** and **58** on the information below.

A 1.00-meter length of nichrome wire with a cross-sectional area of 7.85×10^{-7} meter^2 is connected to a 1.50-volt battery.

57. Calculate the resistance of the wire.

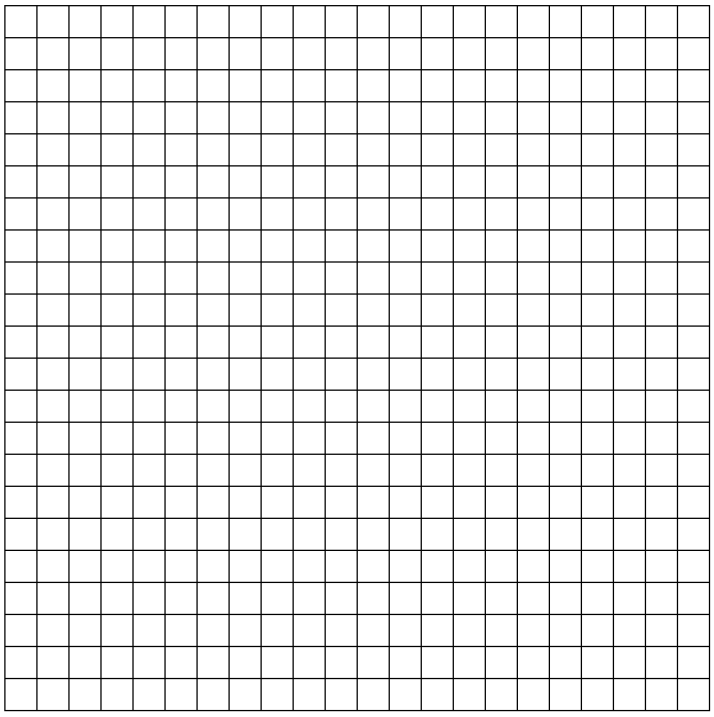
58. Determine the current in the wire.

Practice Final C

59. In a laboratory exercise, a student kept the mass and amplitude of swing of a simple pendulum constant. The length of the pendulum was increased and the period of the pendulum was measured. The student recorded the data in the table below.

Length (meters)	**Period** (seconds)
0.05	0.30
0.20	0.90
0.40	1.30
0.60	1.60
0.80	1.80
1.00	2.00

Period vs. Length of Pendulum

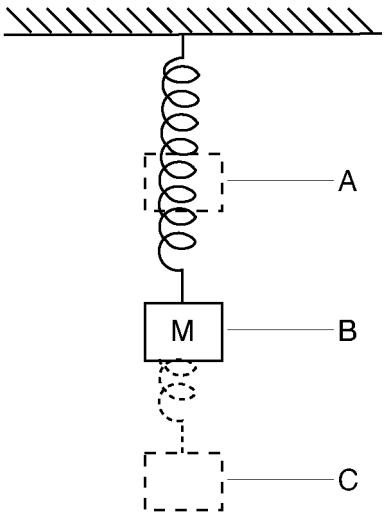


a Label each axis with the appropriate physical quantity and unit. Mark an appropriate scale on each axis.
b Plot the data points for period versus pendulum length.
c Draw the best-fit line or curve for the data graphed.
d Using your graph, determine the period of a pendulum whose length is 0.25 meter.

Practice Final C

Base your answers to questions **60** through **62** on the information and diagram below.

A mass, *M*, is hung from a spring and reaches equilibrium at position *B*. The mass is then raised to position *A* and released. The mass oscillates between positions *A* and *C*. [Neglect friction.]



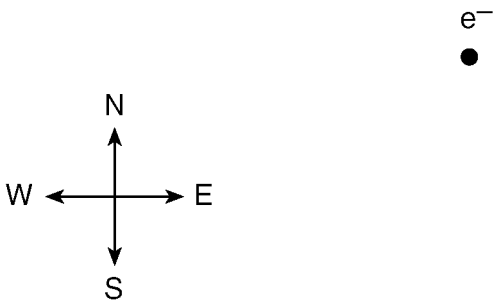
60. At which position, *A*, *B*, or *C*, is mass *M* located when the kinetic energy of the system is at a maximum? Explain your choice.

61. At which position, *A*, *B*, or *C*, is mass *M* located when the gravitational potential energy of the system is at a maximum? Explain your choice.

62. At which position, *A*, *B*, or *C*, is mass *M* located when the elastic potential energy of the system is at a maximum? Explain your choice.

63. Base your answer to the following question on the information below.

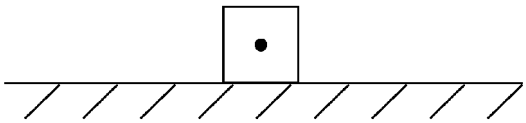
A force of 6.0×10^{-15} Newton due south and a force of 8.0×10^{-15} Newton due east act concurrently on an electron, e^-.



a On the diagram, draw a force diagram to represent the *two* forces acting on the electron. (The electron is represented by a dot.) Use a metric ruler and the scale of 1.0 centimeter = 1.0×10^{-15} newton. Begin each vector at the dot representing the electron and label its magnitude in newtons.
b Determine the resultant force on the electron, *graphically*. Label the resultant vector *R*.
c Determine the magnitude of the resultant vector *R*.
d Determine the angle between the resultant and the 6.0×10^{-15}-newton vector.

64. Base your answer to the following question on the information below.

A force of 10. Newtons toward the right is exerted on a wooden crate initially moving to the right on a horizontal wooden floor. The crate weighs 25 Newtons.



a Calculate the magnitude of the force of friction between the crate and the floor.
b On the diagram, draw and label all vertical forces acting on the crate.
c On the diagram, draw and label all horizontal forces acting on the crate.
d What is the magnitude of the net force acting on the crate?
e Is the crate accelerating? Explain your answer.

65. Base your answer to the following question on the information below.

An electron in a hydrogen atom drops from the $n = 3$ energy level to the $n = 2$ energy level.

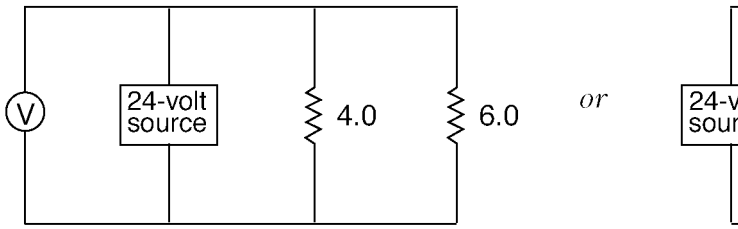
a What is the energy, in electronvolts, of the emitted photon?
b What is the energy, in joules, of the emitted photon?
c Calculate the frequency of the emitted radiation.
d Calculate the wavelength of the emitted radiation.

Reference Tables

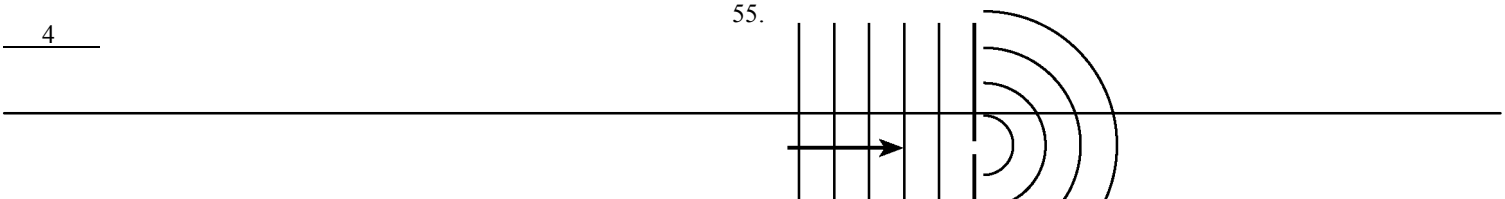
List of Physical Constants		
Name	**Symbol**	**Value**
Universal gravitational constant	G	6.67×10^{-11} N•m^2/kg^2
Acceleration due to gravity	g	9.81 m/s^2
Speed of light in a vacuum	c	3.00×10^8 m/s
Speed of sound in air at STP		3.31×10^2 m/s
Mass of Earth		5.98×10^{24} kg
Mass of the Moon		7.35×10^{22} kg
Mean radius of Earth		6.37×10^6 m
Mean radius of the Moon		1.74×10^6 m
Mean distance—Earth to the Moon		3.84×10^8 m
Mean distance—Earth to the Sun		1.50×10^{11} m
Electrostatic constant	k	8.99×10^9 N•m^2/C^2
1 elementary charge	e	1.60×10^{-19} C
1 coulomb (C)		6.25×10^{18} elementary charges
1 electronvolt (eV)		1.60×10^{-19} J
Planck's constant	h	6.63×10^{-34} J•s
1 universal mass unit (u)		9.31×10^2 MeV
Rest mass of the electron	m_e	9.11×10^{-31} kg
Rest mass of the proton	m_p	1.67×10^{-27} kg
Rest mass of the neutron	m_n	1.67×10^{-27} kg

Practice Final C
Answer Key
NYS Regents [Jan 29, 2003]

1. 3
2. 1
3. 3
4. 4
5. 2
6. 1
7. 4
8. 2
9. 2
10. 1
11. 3
12. 2
13. 3
14. 1
15. 3
16. 2
17. 3
18. 3
19. 4
20. 1
21. 1
22. 2
23. 4
24. 1
25. 2
26. 4
27. 4
28. 2
29. 1
30. 4
31. 3
32. 2
33. 2
34. 4
35. 4
36. 4
37. 1
38. 3
39. 2
40. 2
41. 2
42. 1
43. 4
44. 3
45. 4
46. 2
47. 2
48. 1
49. 3
50. 4
51. 1
52. $t = 2.00$ s
53.



54. 2
55.



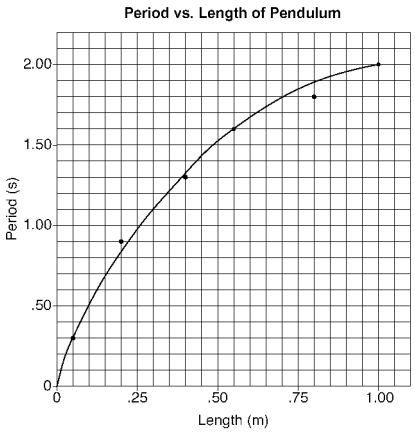
Practice Final C
Answer Key
NYS Regents [Jan 29, 2003]

56. The strong force or the strong nuclear force prevents the nucleus of a helium atom from flying apart.

57. $R = 1.91\Omega$

58. 0.785 A

59.



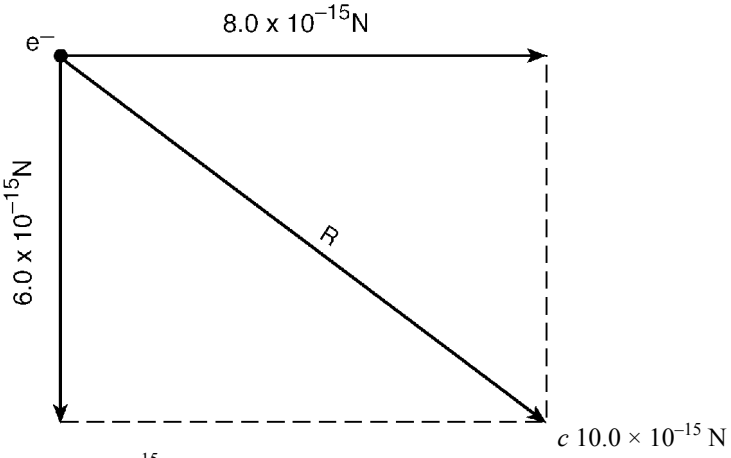
d 1.0 s ± 0.03 s.

60. *B*, because the mass has the greatest speed or
B, because the total potential energy is least or
B, the speed at *A* and *C* is zero

61. *A*, because it is the highest point of travel

62. *C*, because the spring is stretched the maximum amount or
C, because the KE and gravitational PE are a minimum

63.



c 10.0×10^{-15} N

$\pm 0.2 \times 10^{-15}$ N

d 53° ± 2°.

64.

a *Ff* = 7.5N

d 2.5 N.

e The crate is accelerating because a net force acts on it.

65. *a* 1.89 eV.

b 3.02×10^{-19} J.

c $f = 4.56 \times 10^{14}$ Hz

d $\lambda = 6.59 \times 10^{-7}$ m